THURSDAY, OCTOBER 17, 1918.

THE SALVAGE OF NINETEENTH-CENTURY SCIENCE.

Theory of Functions of a Complex Variable. By Prof. A. R. Forsyth. Third edition. Pp. xxiv + 855. (Cambridge: At the University Press, 1918.) Price 30*s.* net. (First edition, 1893, pp. xxii + 682; second edition, 1900, pp. xxiv + 782.).

TO anyone interested in the progress of British science the appearance of a third edition of this spacious volume, well-nigh two hundred pages longer than the first edition, must be a very welcome event. All those who know the conspicuous services which the author has rendered to mathematical learning will wish to congratulate him. And those who have known the stimulus of personal contact with him, who can recognise, beneath the happy diction with which the book is everywhere written, the sympathetic teacher, always able and willing to realise the learner's point of view, but eager to inform with a wealth of detail that is truly wonderful, will remember and be grateful. For the book stands between a time when, largely by the exigencies of a certain examination, a proof was soundest if it involved a considerable piece of algebra, and a time when the youngest student can prove anything by a judicious arrangement of arrow-heads. And the multiplicity of its content, who shall describe? Nor is it possible to say that it is too long if it be remarked that the index contains, for example, neither the entry "aggregate" nor the entry "enumerable."

It is easy; of course, for a reviewer, taking sections of the subject over which he happens to have pondered more intently than wisely, maybe, to explain how much better the book could have been, or to exemplify—what mathematical students do not usually know—the number of amendments necessary to the finished form of a mathematical theorem. And some indications may be given of how the present reviewer would discharge this traditional ungrateful duty if he were compelled to it. But they may be brief, and limited to the earlier parts of the book. As regards nomenclature, there was an opportunity for rendering the use of the words *analytic* and *monogenic* more uniform. The French use (Cauchy, Picard, Goursat, etc.) differs from the best German use. Compare Weierstrass's statement in regard to a construct ("Werke," iv., p. 13; or iii., p. 101): "und bezeichne dasselbe als ein monogenes weil es in seinem ganzen Umfange durch irgend eins seiner Elemente vollständig bestimmt ist." As regards uniform convergence there is some change in the present edition, the remarks on p. 92 (*cf.* the theorem, p. 156) differing from the statement on pp. 83, 84 of the second edition, and still more from those on p. 127 of the first edition, where the phrase "für jedes dem Bereiche angehörige Werthsystem" is untranslated. The difference between the case of a series of real functions and that of a series of functions of a complex variable might usefully be remarked. In regard to the definition of a function of a complex variable there is no substantial change; there is no reference to the question whether the derivatives of the function need be assumed continuous; and a holomorphic function is both monogenic and continuous. And in regard to the fundamental question of the integration of a function of the complex variable there still remains what is surely a very substantial incompleteness. If it be held that the curve of integration need not be rectifiable, and the continuity of the function need not be uniform, it should surely be so stated. As examples of complaints that may be put forward for later pages, we select only three. The statement on p. 248, that the integral can be made to assume *any* value, is incorrect. The proof on p. 245, for any three periods of a doubly periodic function, does not seem to carry Corollary II. without further amplification. The footnote on p. 344 might now be supplemented by reference to Painlevé, "Acta Math.," xxvii. (1903), and Camb. Phil. Proc., xii. (1903), p. 235.

But all this class of criticism seems impertinent to such a corpus of learning. There are two other reflections which are suggested by its perusal. When one turns over its brilliant pages and inquires of the history, one has sorrowfully to confess that not any substantial or path-breaking development has been made by British thinkers. All this illuminating theory, so important for the history of human thought, we owe to Frenchmen or Germans, or others. The great names are Cauchy, Abel, Riemann, Weierstrass, and Poincaré. It is a very interesting question: Why is this so? In the second place, nearly all this matter is the work of the nineteenth century. When the present war shall finally cease, how long will it be before mankind will be able again to turn from the inevitable necessity for the production of commodities to putting together such another body of clarifying thought? Well indeed is it that such a summary as this volume constitutes has been made, and very grateful should we be to the author—for such work remains among the imperishable records of human endeavour, a real joy for ever—but will a similar, or even a more productive, salvage be possible in 2018?

A TEXT-BOOK OF PLANT PHYSIOLOGY.

Plant Physiology. By Prof. V. I. Palladin. Authorised English edition. Edited by Prof. B. E. Livingston. Pp. xxv + 320. (Philadelphia: P. Blakiston's Son and Co., 1918.) Price 3 dollars net.

IT has been a matter for surprise to those who were familiar, through the German edition, with Prof. Palladin's text-book of plant physiology that it had not hitherto been available in English. The German edition, which was based on the sixth Russian edition, appeared in 1911, so that we have had to wait unduly long for the

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present translation, which appears under the editorship of Prof. Livingston, of the Johns Hopkins University. The present work is based on the German edition, but it has been collated with the seventh Russian edition, which appeared in 1914, and any alterations have been included in the English text. Hitherto there has been available to students no text-book of plant physiology of small compass which could serve as an introduction to the larger works of Pfeffer and Jost. This book admirably fills the gap.

On p. 2 of the Introduction we find a list of the heats of combustion of hydrogen, carbon, starch, glucose, etc., and on p. 3 a discussion of the catalytic action of enzymes. It is thus clear from the outset that the author views the plant from the physico-chemical point of view, and keeps well to the front the dynamical aspects of the chemical processes occurring. Associated with this we find that—in the words of the editor—"Palladin's writing is more free from teleological misinterpretation of the relation between conditions and results than is that in most of the text-books hitherto available." The book may thus safely be put into the hands of students without the risk of the acquirement of a slovenly and unprogressive habit of thought.

The editor has provided footnotes—the authorship of which is clearly indicated—where the matter required bringing up to date or the author's treatment of a subject seemed to require elucidation or correction. These additions very greatly increase the value of the book, and many of them, as readers of Prof. Livingston's papers might expect, are models of what critical notes should be. These notes are most numerous in connection with photosynthesis, osmotic pressure, and water movement.

The book naturally brings to the front the work of Russian botanists, and renders available some results which the barrier of language has hitherto kept almost unknown. The treatment of fermentation and respiration, subjects to which valuable contributions have been made by Palladin and his pupils, is particularly good, but Kidd's work on the effect of carbon dioxide on both aerobic and anaerobic respiration should have been noted. The relation of oxygen to fermentation by yeast, which is imperfectly or erroneously treated in most text-books, is well brought out, though reference might have been made to the work of Horace Brown on the "occlusion" of oxygen by yeast-cells. Readers will be particularly glad to have an account of Palladin's work on the respiration of dead plants and of his chromogen theory of respiration. In dealing with transpiration both the part played by the stomata and the physical factors controlling the rate of diffusion of water-vapour from the plant might have been dealt with more fully. Mention might also have been made of the fact that both Gaidukov's observations on the reaction of Oscillaria to light of different colours, and those of Czapek on the relation of homogentisic acid to geotropic response, have been called in question. The treatment of growth, movement, and reproduction in part ii. is very much slighter than that of metabolism, and the subject of heredity is not dealt with at all.

All the citations of literature have been verified and the form of reference has been rendered uniform; special attention has also been paid to the transliteration of Russian names. Botanists will be interested to learn that, on his own authority, the author's name should be pronounced "Pallad′-din." V. H. B.

FUNDAMENTAL PRINCIPLES OF CHEMISTRY.

Stoichiometry. By Prof. S. Young. Second edition. Pp. xiv + 363. (London: Longmans, Green, and Co., 1918.) Price 12*s*. 6*d*. net.

AS was explained in the notice which appeared on the issue of the first edition (NATURE, vol. lxxviii., 1908, p. 98), this book, which forms one of the well-known series of text-books of physical chemistry edited by the late Sir William Ramsay, deals with the fundamental principles of chemistry.

The present notice is devoted primarily to a consideration of the new matter which has been introduced into the book in order to give some account of the results arising from the numerous investigations carried on during the last decade. Of these results, none, perhaps, have had a greater influence on our fundamental conceptions than those which have been arrived at as a consequence of the investigation of radio-active substances. We have become familiar with the idea of non-separable, or isotopic, elements, which may, or may not, have the same atomic weight. Prof. Young adopts the recommendations of Paneth as giving, perhaps, the best definition of the term "element"; according to this suggestion, isotopes are to be regarded, not as different elements, but as varieties of the same element, so that an "element" may be pure or mixed according to whether it contains only one kind of atom or different varieties of isotopic atoms. The recent determinations of the atomic weight of lead derived from different sources, which have a bearing on the same subject, are referred to, while in the chapter dealing with the periodic law, after explaining the modern conception of an atom, the author gives a short *résumé* of the conclusions drawn by Soddy, Russell, and Fajans regarding the positions taken up in the periodic table by the products of the disintegration of atoms. No reference is made in this chapter to the difficulty which has been experienced in including the rare earth elements in the table, while a still more surprising omission is the absence of any allusion to the exceedingly valuable work of Moseley on the X-ray spectra of the elements, which has provided us with a method for the determination of atomic numbers and has led to results of the highest importance.

The numerous investigations relating to osmotic pressure which have been carried on in England

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